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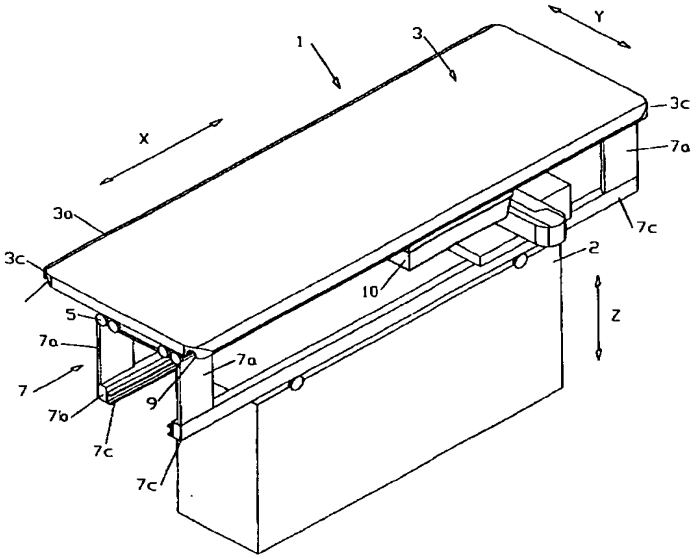
(54) Title: A PATIENT TABLE WITH A FRAME DESIGNED FOR X-RAY DIAGNOSTIC




(57) Abstract: An examination table for diagnosis by X-ray, ultrasound, magnetic response imaging or like processes includes a stand for supporting a vertically, longitudinally and transversely movable table top (3). The table top accommodates a cassette receptor (10) or bucky which may be movable in relation to the table top. The entire table top (3), including its longitudinal side edges (3a), is made of a material that has good radiation transparency, so as to permit exposure over the full width of the table top. The table top is carried by a frame construction (7) which includes support elements (7) that extend down to beneath the receptor (10), where bearing devices (6) for longitudinal movement of the table top are situated. The distance between these latter bearing devices is much smaller than the width of the table top.



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# A patient table with a frame designed for x-ray diagnostic

## Field of invention

The present invention relates to a patient examination table for diagnosis by X-ray, ultrasound, magnetic resonance imaging or like processes and more specifically to a table of the kind defined in the preamble of Claim 1.

Such examination tables have been modified from a simple type of table consisting essentially of an X-ray permeable table top on four fixedly mounted or wheeled legs in the nineteen forties, to a developed motorised unit. This motorised unit is typically provided with a so-called floating table top, i.e. a table top which can be moved in a horizontal plane so as to bring a patient supported on the table to a position relative to a beam source. The table top also accommodates an image receptor for conventional analogue filing systems or for digital systems connected for computerised image processing and filing.

Most tables of this kind are now also designed for motorised movement of the table top in a vertical plane, among other things to enable the patient to climb onto and off from the table more easily, or to facilitate the transfer of a patient from a hospital bed, and also to enable the table top to be raised to any working height chosen by the X-ray personnel.

In order to enable the function of a floating table top to be achieved, the front and rear sides of the table top have hitherto been provided with longitudinally extending profiled sections for the purpose of providing bearings required for movement of the table in its longitudinal direction. Such profiled sections may also be used for mounting different auxiliary devices, such as manoeuvring devices, object supports, compression units, etc. The manoeuvring devices may, e.g., consist of one or more

manoeuvring handles and a manoeuvring box, which are often integrated to form a unit.

One such manoeuvring handle enables the table top to be released from a locked state, so as to enable the patient to be positioned relative to a beam or radiation source. Some types of manoeuvring handles can be placed selectively along the table profiled sections and fixed while taking practical and ergonomic requirements into account.

There is a risk of injury when using as a manoeuvring handle a profiled section that is not intended for this particular purpose, particularly when the profiled section concerned permits contact with the table-top bearing means. This risk of injury is made worse when the patient grips around the side edges of the table top, since there is a danger that movement of the table top will result in pinching or squeezing of the patient and that said movement cannot be stopped in time by some other person in order to prevent this from happening.

The profiled sections on the side edges of the table are normally made of a metal alloy, which enhances table-loading possibilities and limits rolling resistance as the table top is moved, something which also fulfils ergonomic requirements with respect to handling of the table top. However, such an alloy is not transparent to X-ray beams for instance. This constitutes a serious drawback from a clinical aspect, namely that the table profile will be recorded on the image.

When using an X-ray permeable material for the table profiled sections, for example carbon fibre, kevlar or some corresponding composite material, or acrylic plastic (Plexiglass), the thicknesses to which the sections must be made would result in sections that gave rise to image disturbances or impairment. The thickness of said material is minimised in order to minimise the absorption of radiation by the table top between the side profiles. However, this thickness reduction with respect to said profiled sections is only possible to a limited extent, for table loading reasons. In

other words, it is extremely difficult to avoid image disturbing elements from the profiled sections.

This is often associated with difficulties in positioning the patient centrally on the exposable part of the table top. Certain large-girth patients may even be broader than this exposable part. In such cases it becomes necessary to move the patient so that the object can be positioned outside the image disturbing profiled section. This situation becomes worse when examining injured patients or patients that suffer pain from other causes. Moreover, movement of heavy patients and bulky patients subjects the personnel involved to the danger of acute stress injuries or to wear injuries or lacerations, in the long term.

Although an increase in the total width of the table top would reduce these drawbacks to some extent, it would also impair ergonomics and patient handling on the one hand and the manoeuvring and operating functions on the other hand. The greater distance of the patient from the long sides of the table top thereby entailed would impair accessibility and increase the distance through which a patient must be moved between table and bed or stretcher trolley. Moreover, the use of such auxiliary devices as compression bandages, which must normally be fastened from both the front side and the rear side of the table top, will be more difficult.

Known table tops have hitherto caused problems in respect of the use of different image formats, the size of which shall be adapted from time to time to the size of the object. The object is normally positioned centrally in the image field. When X-rays are the beam source, a transition from analogue film technology to digital technology takes place through the medium of technology changes, with electronic image storage in so-called PACS (Picture Archive Computed System). The image receptor or the so-called digital detector is coupled directly to the computerised image processing unit in conjunction with the image transfer, in order to simplify handling procedures in this regard and make them more effective.

The conventional digital detector, which is not designed ? for special diagnostic areas, normally has an image field size that corresponds to the largest X-ray film or

image plate. Although the size of the image receptor for X-ray film cassettes corresponds generally to the digital image receptor, the choice of film size is adapted to the size of the object with the intention of saving film. In order to obviate the need to decentralise the position of the cassette in the image receptor – which is a comparatively troublesome process – the cassette is normally centred in the image receptor. This increases the need to move the table top transversely, while the fact that the table profiles may therewith coincide with the position of the object relative to the image field makes it necessary to limit the extent of such transversal movement.

The need to position the object centrally in the image field, is greatly reduced by using in a digital image receptor one and the same image size for different examinations and with varying object sizes. This simplifies many interactive settings of beam source and image receptor, besides reducing the need to move the patient relative to the image receptor. However, the image disturbing table profile is still a greater drawback than it was earlier.

With respect to conventional examination tables it can be said by way of summary that the presence of and the placement of said table profiles often makes the planned examination of the patient more difficult to carry out and constitutes a serious hazard risk.

**Description of the background art**

GB 2 057 830.A (Fothergill & Harvey) describes a surgical operating table that consists of one or more pivotal panels or sections. Each of these panels can accommodate a receptor unit that can be inserted in the longitudinal direction of respective panels. The panels are mutually hinged and all panels or carried by a stand structure that engages solely one of said panels. The table cannot be displaced longitudinally and/or transversely and its basic construction is totally different from that described above. This known table does not permit exposure across the full width of respective panels.

FR 2 110 690.A (Daguillon) describes a table of sandwich construction that includes a totally immovable table top. The table has no receptor and is primarily intended for radiation therapy. This table also lacks any close connection with the invention.

DK 118 300.B (Philips) describes a patient table for X-ray diagnosis that can be moved in the X- and Y-directions, said table including a stationary receptor placed closely beneath the table. The table is carried by twin frames mounted on a central foot, wherein one frame permits movement of the second frame in the Y-direction and the second frame permits movement of the table in the X-direction. A receptor which is stationary relative to the table top often constitutes a drawback, and this arrangement provides no solution to the aforementioned problems.

**Objects of the invention**

In view of the aforesaid problems, one object of the invention is to provide an examination table of the kind defined in the introduction with which the full width of the table top can be used for positioning the patient, without needing to move the patient transversely across the table, such movement being liable to cause the patient discomfort or pain, and/or subjecting attendant personnel to non-ergonomic working methods that lead to injury.

Another object is to provide an examination table that includes a floating table top which enhances patient accessibility and eliminates the risk of pinching or squeezing of either the patient or the attendant personnel.

Another object is to provide an examination table which enables the beam source to project at selected angles without the long sides of the table top influencing or appreciably impairing the resultant image.

Yet another object is to provide an examination table with which, when necessary, the sides of the table top can be designed to enable exchangeable or collapsible collision protectors to be mounted.

## Summary of the invention

These and other objects are achieved with an inventive examination table of the kind defined in the introduction and having the features set forth in the characterising clause of Claim 1.

Because the table top lacks image disturbing parts along the long sides of the table, image exposure can be effected across the total width of the table top, and therewith the total width of the patient, in any chosen position of the patient, in other words without needing to move the patient transversely of the table in conjunction with the exposure. The patient need not therefore be subjected to discomfort or pain. The attendant personnel may also employ ergonomic working methods during the entire examination without needing to risk being subjected to injury as a result of the patient's weight.

Moreover, because the table lacks outwardly or upwardly projecting profiled sections, an injured patient can be pulled from a bed to the examination table on a mattress or on some other kind of underlay.

It is preferred in practice that the table top is supported on the stand by a frame construction that includes supportive elements that extend down to beneath the receptor where the bearing devices for movement of the table top in its longitudinal direction are mounted.

The serious drawbacks of a clinical nature described above are therwith avoided effectively, also by virtue of the fact that the bearing devices for longitudinal movement of the table top do not constitute image disturbing elements.

It is preferred that the bearing devices are located within the width of the table top. This does not impede access to the patient and also eliminates the risk of the patient and personnel being pinched or squeezed.

Moreover, because the side edges of the table top will no longer be subjected to load, they need not be strengthened by making them thicker and the table top can be constructed entirely so as to achieved the best possible X-ray transparency.

One embodiment is characterised in that the long and/or the short sides of the table top have rounded outer profiles to provide a tangential surface that minimises radiation absorption and eliminates image disturbances.

Other characteristic features of the invention and advantages associated therewith will be apparent from the following description of a preferred embodiment of the invention. The description is made with reference to the accompanying drawings.

**Brief description of the drawings**

Figures 1 and 2 are respectively a perspective view and an end view of an examination table according to the earlier standpoint of techniques.
Figures 3 and 4 are corresponding views of an inventive examination table.

Those elements that find correspondence with one another have been identified by the same reference signs, although with the difference that a prime has been added to the reference signs that identify elements belonging to the known table.

**Description of an examination table according to present standpoint of techniques**

Referring to Figures 1 and 2, the reference 1' identifies an examination table for diagnosis by X-ray, ultrasound, magnetic resonance imaging or the like. The table 1' includes a stand 2' for vertical movement of a table top 3'. Also illustrated is the ability of the table top to move in the longitudinal direction (X-direction) and transversal direction (Y-direction) of the table. Bearings in the form of rollers 6' provided with ball bearings are mounted between the stand 2' and the table top 3' for movement of the table top in its longitudinal direction relative to the stand. Corresponding bearing devices 5' are provided for transverse movement of the table.

The bearing devices 6' are accommodated in metal side profiled sections 4' that extend along the side edges of the table top 3'.

The bearing devices 6' may co-act with releasable latching devices, for instance release magnets (not shown), which hold the "floating table top" 3' releasably fixed in alternative positions both longitudinally and transversely relative to the stand 2'.

There may be provided along the longitudinally extending side profiles 4' manoeuvring grips or hand grips (not shown) that can be gripped by an attendant person or operator in order to move the table top, and the patient carried thereby, to a desired position relative to a beam source (not shown).

The table top 3' also carries a receptor or bucky 10' which may also be movable relative to the table top 3'.

A serious drawback of the metal sides profiles 4' from a clinical aspect is that they may be recorded on the exposed image, i.e. cause image interference or disturbance. Moreover, the rollers 6' connected with the side profiles 4' represent serious pinching risks to both patient and personnel.

The bearing devices, i.e. the rollers 6', are carried by a frame construction 7' fixedly joined to the stand 2'. This frame construction 7' thus accompanies the stand in its

vertical movement (Z-direction), while the table top 3' is movable relative to the frame 7' in the X-direction and Y-direction.

**Description of a preferred embodiment of the invention**

The table top 3 of the inventive examination table illustrated in Figures 3 and 4 differs from the table top 3' shown in Figures 1 and 2, among other things by the fact that it lacks metal side profiles 4'. Instead, the entire table top 3, including its longitudinal side edges 3a, is comprised of a material that has good radiation permeability, e.g. carbon fibres or kevlar. This permits exposure across the full width of the table top 3, without needing to fear image disturbances caused by metal material.

As with the known examination table, the table top 3 carries a cassette receptor or bucky 10, which may also be movable in relation to the table top in this case.

The illustrated table top 3 is also a so-called floating table top, i.e. it can be moved both longitudinally and transversely, wherewith the bearing devices 5 for transversal movement may be situated at a different level, preferably a higher level, than corresponding devices used with the known table design.

Another substantial difference in relation to the known examination table 1' is that the frame construction 7 supporting the table top 3 is movable in the X-direction relative to the stand 2. Thus, the frame construction 7 includes vertically extending support elements 7a which extend downwardly of the receptor or bucky 10, where support elements 7a located in the region of ends of the table top 3 are connected in pairs by longitudinally extending bars 7b which include inwardly facing guides 7c for bearing devices or rollers 6 that enable the table top to move in its longitudinal direction.

The arrangement in which the rollers 6 are located at a lower level will not result in image disturbances either. The bearing devices 5 provided for transversal movement

will not cause problems relating to image disturbances, since these bearing devices are located at the end edges of the table top 3.

The transverse spacing of the rollers 6 for longitudinal movement is much smaller than the distance in the known table design according to Figures 1 and 2, i.e. the rollers 6 are located at a distance apart which is much smaller than the width of the table top.

The table top 3 has a flat upper surface, i.e. it lacks outwardly projecting edges or contours.

The long sides 3a of the table top merge with its short sides via rounded outer portions 3c so as to form a tangential surface which reduces radiation absorption and eliminates image disturbances. The beams emitted in different ways from the radiation source have been shown in Figure 2.

Provided on the underside of respective long side edges of the table top 3 is a downwardly facing groove 9 which, when required, may be provided with one or more contactless operating functions or operating functions that can be activated by touch, for example through the medium of a table grip. Alternatively, the grooves can function for passage of a beam for detection by a sensor (not shown) at one end of the table profile. In this regard, the means that latch the table top may be released by inserting fingers into the space so as to break the beam.

Alternatively, the grooves 9 may accommodate a touchable electric contact strip that releases the table-top latching means when activated.

The vertical and inclined arrows in Figure 4 are intended to show that a table top according to the invention enables projection of the radiation source at any chosen angle without the long sides of the table top affecting or impairing the imaging result.

If desired, the long and/or the short sides of the table top may be designed for simple application of interchangeable or collapsible collision protectors.

# CLAIMS

1. A patient examination table for diagnosis by X-ray, ultrasound, magnetic resonance imaging and like processes, wherein the table includes

a) a vertically movable stand (2),

b) a table top (3) carried by said stand for movement in the horizontal plane,

c) bearing devices (6, 5) for longitudinal and/or transversal movement of the table top,

d) releasable latching means for holding the table top releasably fixed in alternative positions relative to the stand,

e) one or more cassette receptors (10) or buckies supported by the table top either in or beneath said top, said receptor or bucky possibly being movable relative to the table top (3)

**characterised in** that

the entire top (3) including its longitudinal side edges (3a) are made of a material that has good radiation transparency, so that exposure can be achieved over the full width of the table top.

2. An examination table according to Claim 1, **characterised in** that the table top (3) is supported on the stand (2) by a frame structure (7) which includes support elements (7) that extend down to beneath the receptor (10), where the bearing devices (6) for longitudinal movement of the table top are situated.

3. An examination table according to Claim 2, **characterised in** that the bearing devices (6) are located within the width of the table top (3).

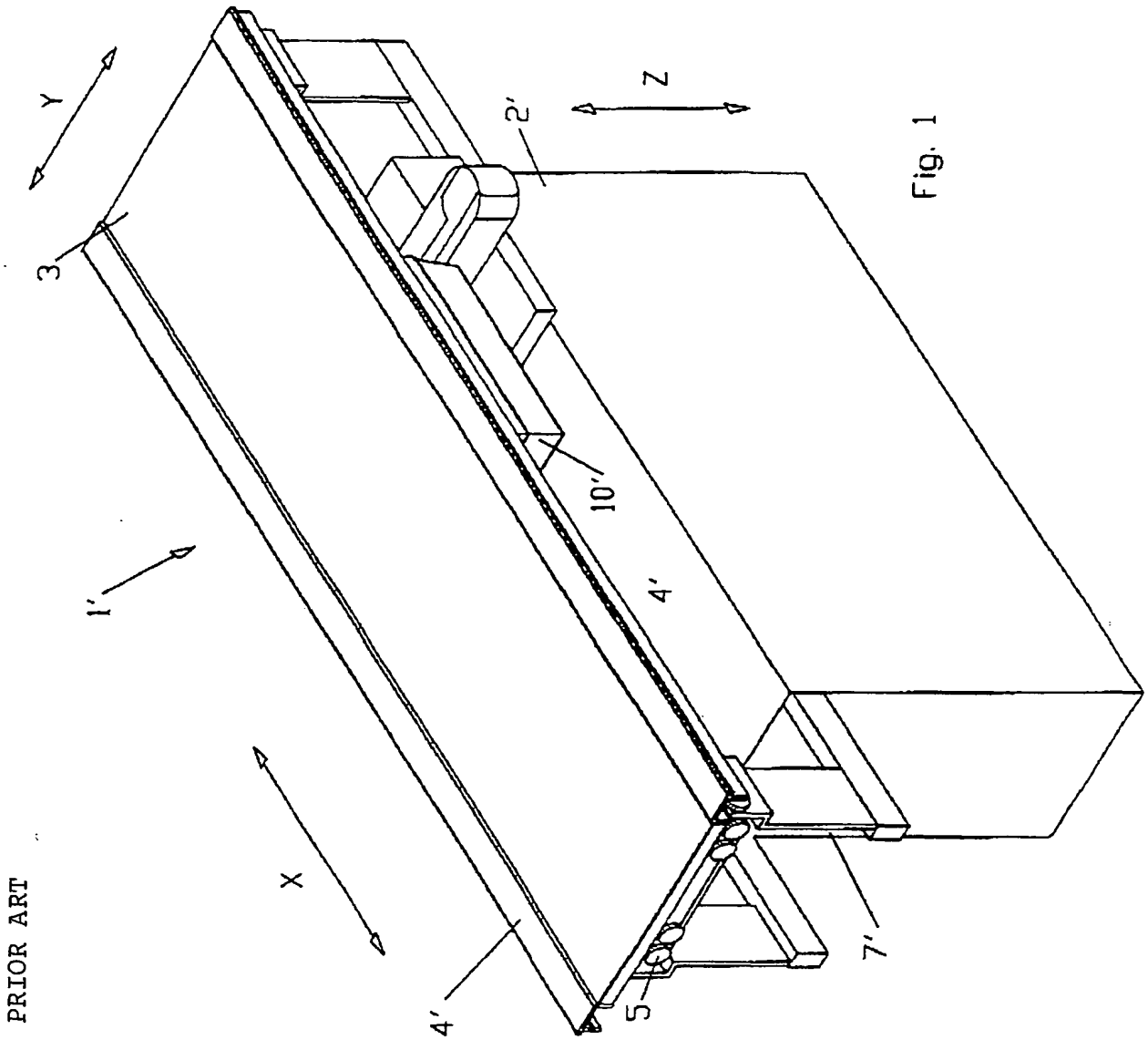
4. An examination table according to Claim 3, **characterised in** that the upper surface of the table top (3) is flat and lacks outwardly projecting edges or contours.

5. An examination table according to Claim 4, **characterised in** that the long and/or short sides of the table top have rounded outer parts (3c) such as to form a tangential surface that reduces radiation absorption and eliminates image disturbances.

6. An examination table according to Claim 2, **characterised in** that the bearing devices (5) for movement of the table top (3) transversely (Y-direction) are situated in the region of the underside of said table top.

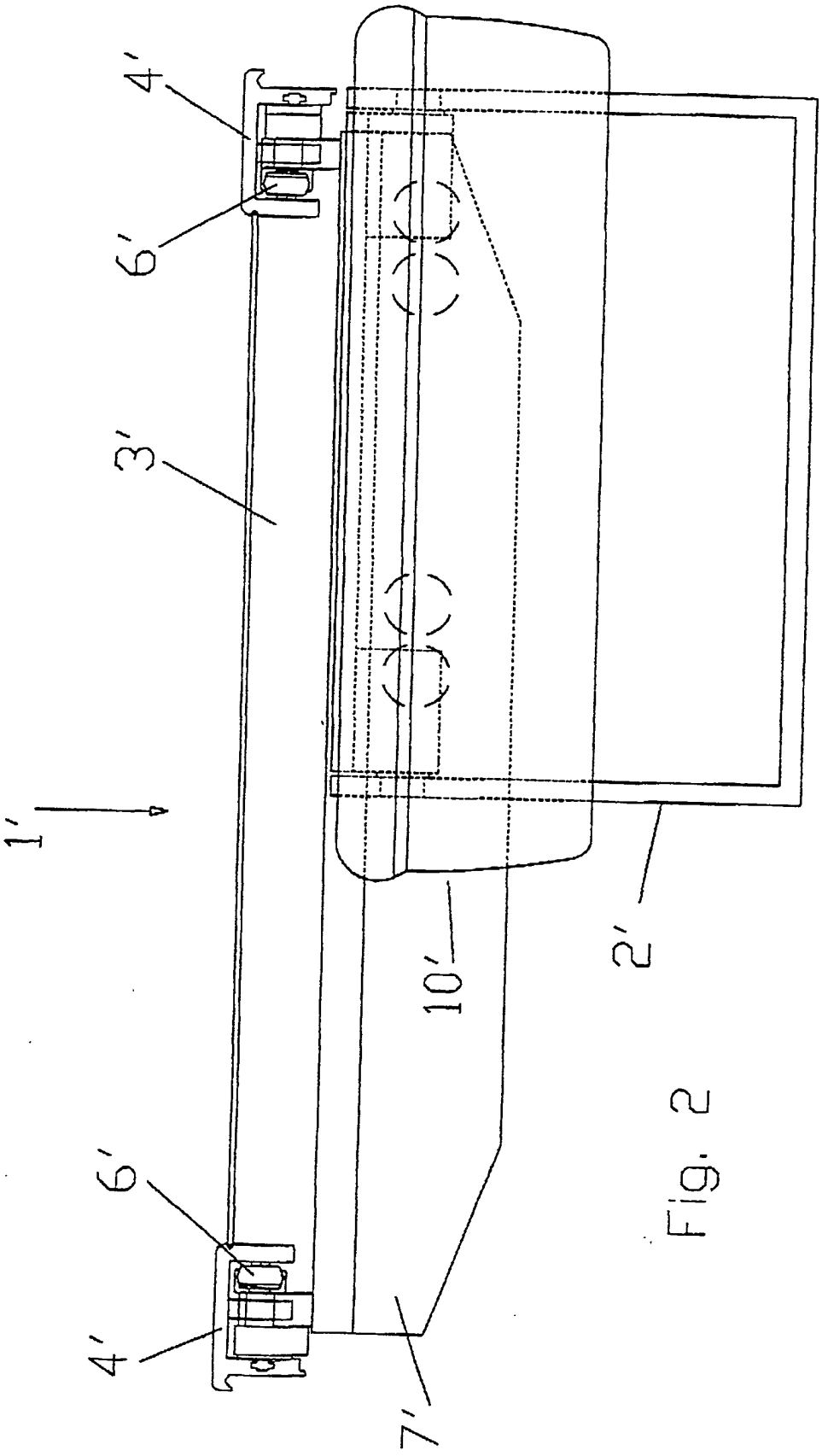
7. An examination table according to any one of Claims 1-6, **characterised in** that the table top (3) is provided at its respective side edges with a downwardly facing groove (9) for accommodating a contactless manoeuvring function or a touchable manoeuvrable function, such as a table grip for instance.

8. An examination table according to any one of Claims 1-7, **characterised in** that the long and/or short sides of the table top (3) are constructed for application of interchangeable or collapsible collision protectors.




PRIOR ART

Fig. 1




PRIOR ART

Fig. 2

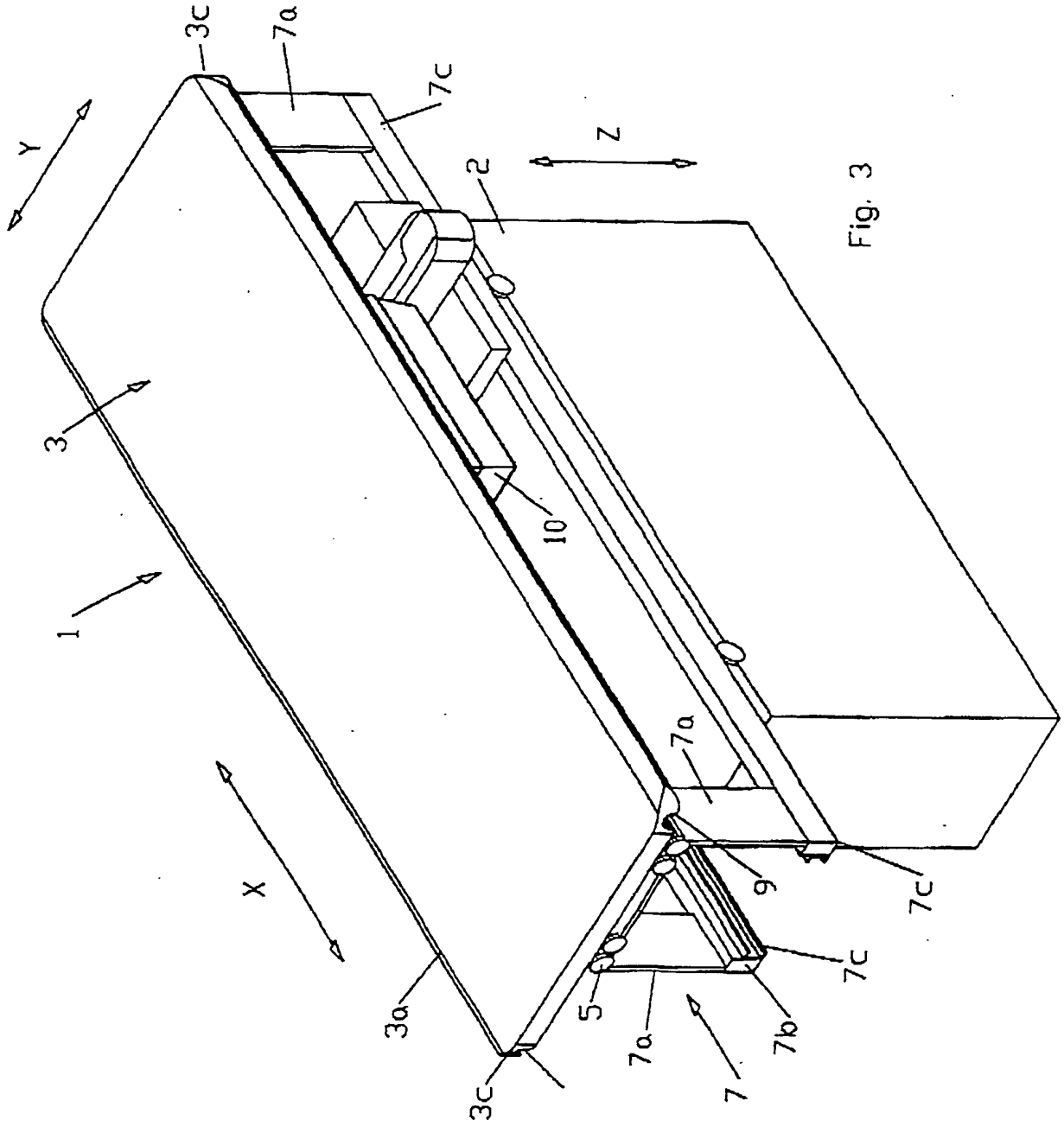



Fig. 3

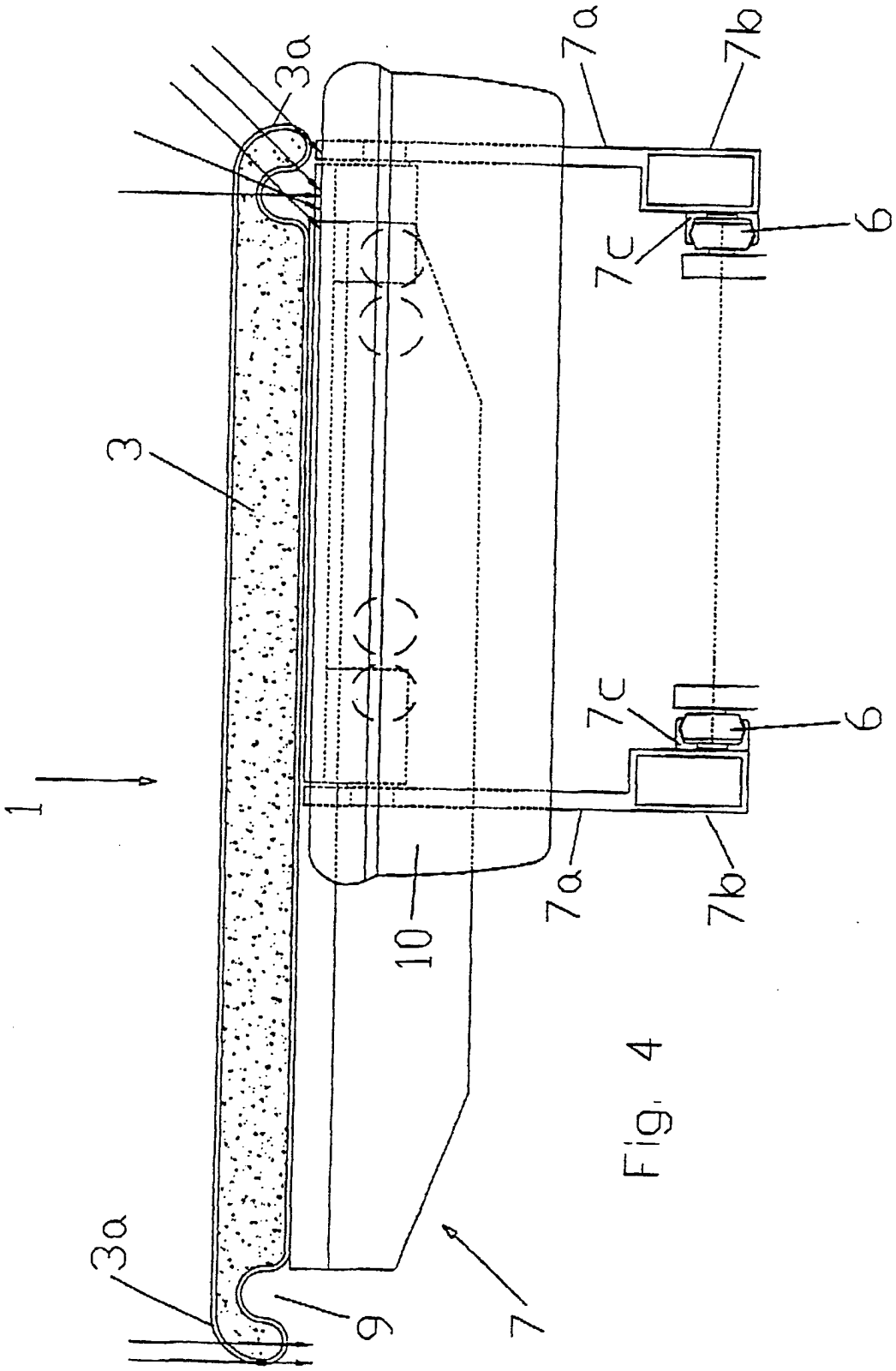



Fig. 4

# INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61B 6/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI-DATA, EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
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# INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

06/11/01

International application No.
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